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ORIGINAL PAPER

Mindful Construal Reflections: Reducing Unhealthier Eating Choices

Misba Hussain[1] · **Helen Egan**[1] · **Rebecca Keyte**[1] · **Michail Mantzios**[1]

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Abstract

Objectives Regularly choosing unhealthy energy-dense foods can have negative health consequences. The present study tested whether a mindful eating–specific tool, namely Mindful Construal Reflection (MCR), would promote healthier eating behaviors.

Methods Eighty-five university students were randomly assigned to either a mindfulness or control condition and were served M&Ms and grapes as an unhealthy and healthy option respectively.

Results Participants in the mindfulness condition consumed significantly less M&Ms than those in the control condition, but no significant differences were found in the consumption of grapes between the two conditions. Furthermore, control participants ate significantly more M&Ms when displaying some hunger compared to those presenting no hunger, and although participants in the mindfulness condition also ate more when displaying some hunger, this did not reach statistical significance.

Conclusions Together, these results suggest that the MCR may be effective in reducing consumption of unhealthy energy-dense foods. However, future research is warranted in developing the MCR to encourage consumption of healthier food options.

Keywords Mindfulness · Mindful concrete construals · Food choice · Healthy eating · Unhealthy eating

Transition to university is a time of change and, on campus living, has been associated with poorer eating habits (Sprake et al., 2017; Tanton et al., 2015). Students often cite a lack of time, limited knowledge of how to prepare healthy foods, and easy access to unhealthy foods as barriers to healthy eating (Ashton et al., 2016; Escoto et al., 2012). Higher consumption of convenience and energy-dense foods has been associated with a lower intake of fruit and vegetables, and university students have been reported to consume well below the public health agency recommended five portions of fruit and vegetables per day (Small et al., 2013). Such unhealthy eating behaviors have shown to result in significant weight gain (Vadeboncoeur et al., 2015), which usually continues throughout adulthood. Therefore, interventions for healthy eating amongst student populations may be important and timely.

✉ Misba Hussain
Misba.hussain@mail.bcu.ac.uk

[1] Department of Psychology, Faculty of Business, Law and Social Sciences, Birmingham City University, The Curzon Building, 4 Cardigan St., Birmingham B4 7BD, UK

Typically, consumers make an average of over 200 food-related choices per day (Wansink & Sobal, 2007), and such choices can be significantly affected by the "obesogenic environment" (Chaput et al., 2011). For example, research has shown that supermarkets' package sizing and restaurants and fast-food portions have all increased in recent years (Steenhuis & Poelman, 2017; Wansink et al., 2009). However, eating habits are not only concerned with the amount that people eat but also the type of foods consumed. Indeed, the ubiquitous availability of high-energy foods can make healthy and low-caloric choices difficult (Hartmann et al., 2012). To improve eating behaviors, changes need to be made in dietary intake. For example, increasing fruit and vegetable intake and reducing the consumption of energy-dense foods can significantly aid in weight regulation (Hill et al., 2003). Therefore, investigating effective methods that encourage people to make healthier eating choices is essential.

Several studies have identified different methods in influencing the choice towards healthier eating habits, including the role of visual fields, social influences, and priming (Anschutz et al., 2008; Burger et al., 2010). Romero and

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Biswas (2016) found that healthier food options are significantly more likely to be selected when they are placed on the left visual field compared to the right visual field. The influence of descriptive social norms has been investigated and findings suggest that exposure to descriptive information of social norms leads participants to increasingly choose healthier eating options, such as increasing vegetable intake (Mollen et al., 2013; Robinson et al., 2014). Simple health primes have also shown to stimulate healthier eating behaviors, whereby diet cues in a TV commercial reduced unhealthy snack consumption among dieters (Anschutz et al., 2008). Similarly, exposing dieters to the cover of a health and diet magazine led participants to fewer hedonic food choices (Versluis & Papies, 2016). Field findings also found that simple health primes reduced the purchase of energy-dense snacks by up to 75% among overweight and obese individuals (Papies et al., 2014). Such findings suggest that health primes can shift attention away from attractive high-caloric foods, and instead towards choosing healthier eating options, making priming a highly viable intervention tool for the facilitation of healthy food choices. However, enacting the elements of priming of one's own accord is not a clear-cut process. An intervention tool that actively enables people towards the act of priming may be required in order to maintain healthy eating behaviors (Mantzios & Wilson, 2014).

Over recent years, mindfulness has been used as a successful intervention strategy in promoting healthier eating practices, such as reduced food cravings, decreased calorie intake, and loss and increased diet self-efficacy (Albert et al., 2010; Jenkins & Tapper, 2013; Jordan et al., 2014; Timmerman & Brown, 2012). Hunger can impact our attitudes towards food choices—typically boosting the attractiveness of energy-dense foods (Amin & Mercer, 2016; Siep et al., 2009) and triggering automatic eating-orientated reactions (Papies et al., 2008). However, research has shown that mindful attention can help diminish the attractiveness towards such foods by viewing simulations of eating attractive but unhealthy foods as mere mental events, subsequently resulting in reduced unhealthy snacking (Marchiori & Papies, 2014).

Mindfulness has been described as an awareness that emerges through purposefully paying attention to what is taking place in the present moment with a non-judgmental attitude (Kabat-Zinn, 1990). Experimental studies have shown the practice of mindfulness to successfully encourage healthier eating behaviors (Papies et al., 2012, 2015) and display significant changes in weight loss (Hamilton et al., 2013; Mantzios & Wilson, 2014). Findings from studies suggest that this positive impact occurs by assisting in the gradual change of external to internal eating and improving the ability to monitor and regulate dietary intake (Mantzios & Giannou, 2014; Mantzios & Wilson, 2014). In a number of studies, participants who reported higher levels of mindful eating reported increased intake of fruit and vegetable, a reduction in fat and sugar consumption, grazing, and reduced motivations to eat palatable foods (e.g., Gilbert & Waltz, 2010; Mantzios et al., 2018). Taken together, these findings provide strong evidence that mindfulness can encourage healthier eating behaviors and on a practical level gives guidance as to how consumers can enhance their responsiveness to hunger and satiety cues (Jordan et al., 2014).

The majority of experimental studies on eating behaviors use body scan exercises or short audio recording of mindful instructions. However, current evidence within literature suggests that eating-specific mindful exercises may be more effective in promoting healthier eating behaviors and weight loss than generic mindfulness practices as they are more behavioral relevant (Mantzios & Wilson, 2015). Mantzios and Wilson (2014) developed the Mindful Construal Diary (MCD) which combined the theoretical concepts of both mindfulness and construal level theory (CLT). CLT describes an identification on a close or distant continuum (Liberman & Trope, 1998). While close objects, events, or individuals are represented as concrete, distant objects, events, and individuals are portrayed as abstract. Abstract construals consider *why* actions are being performed, whereas concrete construals focus on *how* they carry out behavior (Freitas et al., 2004). As abstract construals are described using a temporal distancing technique, this makes them unsuitable in the development of mindfulness for two main reasons (see Manztios & Wilson, 2014). Firstly, abstract mindsets involve ruminative, judgmental, and uncertain thinking, and these are mechanisms that are often involved in psychological distress (Galfin & Waltkins, 2011). Secondly, by focusing on the *why* elements of a given situation, one's concern of the present moment would be periodical (Fujita, 2008). In contrast, concrete construals promote present-focused orientation and rarely entail judgment or rumination, elements primarily descriptive of mindfulness (Kabat-Zinn, 1990; Schmeichel et al., 2011). Research has indeed found interacting with the MCD (i.e., writing out the answers to the mindful construal questions while eating) assisted with weight regulation (Mantzios & Wilson, 2014), and related research found reflecting on the mindful construal method (i.e., simply considering the answers to the mindful construal questions while eating) improved state levels of mindfulness, self-compassion, and anxiety (Hussein et al., 2017). In essence, Hussein et al.'s (2017) research led to transforming the MCD to a tool of reflection, henceforth referred to as Mindful Construal Reflection (MCR), which could promote healthier eating choices and explain weight regulation observed in past research.

This study investigated the theoretical conceptualization of concrete construals and mindfulness upon healthier eating

behaviors. Firstly, it was hypothesized that participants who engaged with the MCR by simply reading and reflecting on the questions would be less likely to choose unhealthier food options than participants in a control condition. Secondly, it was predicted that the consumption of unhealthy foods may be higher for participants who are hungry compared to those who are not, but using the MCR will significantly reduce intake of unhealthy food when hungry.

Method

Participants

Eighty-five students attending a university in the West Midlands, UK, were enrolled through an online research participation website. Forty-three participants were randomly allocated to the mindfulness condition and 42 to the control condition. The sample consisted of 72 females and 13 males, with an average BMI of $M = 24.54$ ($SD = 7.23$) and an age of $M = 20.11$ years ($SD = 3.51$). Participants self-identified ethnicities were White or White British ($n = 39$), Black African or Caribbean ($n = 12$), Asian ($n = 26$), mixed ethnicity ($n = 6$), and Arab ($n = 2$). The study was approved by the University's ethical committee, and informed consent was gained from all participants.

Eligibility Participants were informed via an information sheet and consent form that they were not eligible to participate if they had any nut allergies or if they had been diagnosed with an eating disorder.

Procedures

Enrolment The study was advertised as an experiment regarding affective responses to food tasting, and was deliberately kept vague in order to prevent people from predicting the true aim of the study. Experimental sessions took place between 12 and 4 pm and lasted approximately 25 min, and participants received course credit for their participation. Upon arrival, participants were randomly assigned to either the mindfulness or control condition. Participants received an information sheet and after providing informed consent, they were seated in individual cubicles in an experimental laboratory.

Experimental Procedure Participants were first asked to provide their height and weight in centimeters and kilograms using a stadiometer and a digital scale, and they were then asked to complete a set of demographic questions and a state mindfulness scale (SMS; Tanay & Bernstein, 2013). Next, depending on the condition, participants were asked to read the MCR or a newspaper article (concerning diesel cars) for 2 min prior to receiving the M&Ms and grapes in order to familiarize themselves with the reading materials. The newspaper article was selected due to its similarity in length of the MCR as well as its absence of food or eating-related matters. Participants were then provided with a portion of M&Ms and a portion of grapes and asked to continue engaging in the reading while eating for another 5 min. A total 7-min framework to read and engage with the MCR was deemed to be appropriate based on previous research that has shown a similar time frame to result in significant improvements in state mindfulness, self-compassion, and anxiety (Hussein et al., 2017). Participants in the control condition also engaged with the newspaper article for the same amount of time. Participants were told they could choose any option of food they wanted (or both) and eat as much as they liked. After 5 min, the experimenter asked participants to finish eating and they were asked to complete another SMS, as well as questionnaires regarding trait mindfulness, trait mindful eating, and eating behaviors. Once the experiment was completed and participants had finished answering the questionnaires, the experimenter carried out a funneled debriefing in order to assess whether any participants were aware of the aims of the study. The funneled debriefing began with a general format of "During the process of completing the questionnaires, did you notice anything in particular?" to more specific questions "If you were to guess, what would you assume was the aim of this study?" Finally, participants were debriefed and thanked for their participation.

Intervention—Use of Mindful Construal Reflection The MCR (and MCD) have previously shown to improve mindfulness longitudinally and within experimental settings (Hussein et al., 2017; see Mantzios & Wilson, 2014). Similar to MCD, MCR is a tool consisting of a total of 13 questions, with the first three questions focusing specifically on the taste, texture, and smell of the food, and the remaining 10 questions combining elements of concrete construal, mindful awareness, and self-compassion. Sample items of the tool include "How understanding and patient am I now that thoughts and feelings are intruding on this pleasurable experience?" and "How do you feel and what passes through your mind now that you are eating this snack?" (see Table 1 for the full list of questions). While the MCD requires participants to write out their answers to the mindful construal questions, the MCR simply involves participants to consider their answers to the questions (Hussein et al., 2017; Mantzios & Wilson, 2014). Participants in the current study were first presented with a sheet of paper containing instructions and questions to the MCR, and they were then asked to read the MCR for 2 min before they started eating in order to familiarize themselves with the intervention. Next,

Table 1 Questions presented to participants in the mindfulness condition

Mindful Construal Reflection (MCR)
How does this snack taste?
How does this snack smell?
What are the colours and texture of it?
How could this snack be better right now?
How could this snack be healthier right now?
How do you feel and what passes through your mind now that you are eating this snack?
How important is it for me and all people to eat healthy?
How kind are you to yourself now that you eat this snack?
How understanding and kind are my thoughts and feelings now that I am eating this snack?
How understanding and patient am I now that thoughts and feelings are intruding on this pleasurable experience?
How understanding and patient am I now that this snack is not a satisfying experience?
How do I show kindness to myself now that I am eating healthily?
How important is this snack right now?

participants were asked to simply consider their answers for 5 min by re-reading the questions while they were eating.

Food Participants in both the mindfulness and control conditions were provided with a 100 g of peanut M&Ms (approximately 512 kcal) and a 100 g of green and red grapes (approximately 72 kcal). Although a typical serving size in the UK is approximately 45 g, a serving of 100 g was provided in this experiment in order to avoid artificially limited intake. The M&Ms and grapes were served in two separate white bowls (15 cm × 15 cm × 8 cm) presented to participants in front of them. All food was brought from UK Tesco stores.

Measures

Participant Information Form Participants were asked questions relating to their age, height, weight, gender, and ethnicity. Such measures were taken in order to gain an insight on participant characteristics and establish whether such factors could have an effect on the final results.

Previous Day and Usual Day Intake of Fruit and Vegetable To assess daily fruit and vegetable consumptions, participants were asked "How many portions of fruit and vegetables did you eat yesterday?" and "How many portions of fruit and vegetable do you normally eat a day?" This measure has been similarly used in previous research (Robinson et al., 2014).

Hunger In order to assess baseline hunger, participants were asked "How hungry are you right now?" and presented with the following number and label responses: 1 (*not at all hungry*), 2 (*slightly hungry*), 3 (*moderately hungry*), 4 (*very hungry*), and 5 (*extremely hungry*). Lower scores represented lower levels of hunger and higher scores represented higher levels of hunger.

Three-Factor Eating Questionnaire (Stunkard & Messick, 1985) The Three-Factor Eating Questionnaire (TFEQ) used in this study was an 18-item instrument created from the translated Swedish version of the original TFEQ (Karlsson et al., 2000). The scale is composed of three subscales: cognitive restraint, uncontrolled eating, and emotional eating. Responses range from 1 (*definitely false*) to 4 (*definitely true)*, and items include "I deliberately take small helpings as a means of controlling my weight" and "When I feel blue, I often overeat". The present study produced the following alphas: cognitive restraint ($\alpha = 0.75$), uncontrolled eating ($\alpha = 0.87$), emotional eating ($\alpha = 0.79$), and overall score ($\alpha = 0.82$).

Mindful Eating Scale (Hulbert-Williams et al., 2013) The Mindful Eating Scale (MES) is a 28-item instrument with responses ranging from 1 *(never)* to 4 *(usually)* and overall scores ranging from 28 to 112. Sample items include "I need to eat like clockwork" and "When I get hungry, I can't think about anything else". The present study produced an alpha of $\alpha = 0.80$.

Five Facet Mindfulness Questionnaire: Short Form (Bohlmeijer et al., 2011) The Five Facet Mindfulness Questionnaire: Short Form (FFMQ-SF) is a 24-item scale that originates from the five facet mindfulness questionnaire (Baer et al., 2004). The scale includes items such as "When I have distressing thoughts or images, I don't let myself be carried away by them" and "I rush through activities without being really attentive to them". Each item is scored from 1 *(never or very rarely true)* to 5 (*very often or always true)*, with

overall scores range from 24 to 120. The present study produced an alpha of α = 0.83.

State Mindfulness Scale (Tanay & Bernstein, 2013) The State Mindfulness Scale (SMS) is a 21-item self-report measure that reflects on traditional and contemporary psychological science models of mindfulness. Responses range from 1 (*not at all*) to 5 (*very well*), with total scores varying from 21 to 105. It includes items such as "I felt that I was experiencing the present moment fully" and "I felt aware of what was happening inside of me". Participants were asked to complete a state measure before receiving the reading materials, M&Ms and grapes, and this measure was based on how they felt in the last 5 to 10 min (prior to the experiment). Participants also completed another SMS after the reading and eating task and were similarly instructed to base their answers again on how they felt in the last 5 to 10 min. The scale has shown to be an effective assessment tool (Hussein et al., 2017). The present study produced the following alphas: pre (α = 0.94) and post (α = 0.94) conditions.

Data Analyses

Consumption of each food was measured in grams, and it was calculated using the difference in weight of each bowl before and after each experimental session. Calories (kCal) consumed were calculated by multiplying the weight of the fruit by 0.72 and multiplying the weight of the chocolate by 5.12. Chi-square was also used to account for differences in gender and food choice between conditions. A 2 × 2 ANOVA was planned to test whether an improvement in state mindfulness scores was observed. *T*-tests were conducted to test for differences in age, BMI, hunger, previous and usual day fruit/vegetable intake, total TFEQ, TFEQ subscales (e.g., cognitive restraint, uncontrolled eating, and emotional eating), MES, FFMQ, and to compare mean values of food intake from M&Ms and grapes consumed between the two conditions. ANCOVA was used to control for such variables in subsequent analyses. The hunger scale used as a covariate was initially run as a continuous variable, and a split on the hunger scale was then conducted gaining a dichotomous variable. Participants who scored at a 1 (*not at all hungry*) were categorized as having no hunger, and those who scored at a 2 or above (*slightly hungry or more*) were categorized as having some hunger. Any significant covariates were followed up with the *t*-tests and Mann–Whitney *U* tests. All analyses were conducted using SPSS v24.

Results

The funneled debriefing procedure indicated that participants were not aware of the aims of the study. Chi-square analysis showed that gender did not significantly differ between the mindfulness and control conditions, χ^2 (1) = 0.07, $p = 0.80$. Eighteen participants were labelled as having no hunger (mindfulness $n = 8$; control $n = 10$) and 67 participants were identified as having some hunger (mindfulness $n = 35$; control $n = 32$ [slightly hungry: mindfulness $n = 16$, control $n = 20$; moderately hungry: mindfulness $n = 15$, control $n = 9$; very hungry: mindfulness $n = 3$, control $n = 3$; extremely hungry: mindfulness $n = 1$, control $n = 0$]). *T*-tests were also conducted to test for differences in participant characteristics, such as age, BMI, hunger, previous and usual day fruit/vegetable intake, total TFEQ, TFEQ subscales (e.g., cognitive restraint, uncontrolled eating, and emotional eating), MES, and FFMQ. As Table 2 shows, there were no significant differences found between the two conditions regarding such characteristics: all $p > 0.20$. All characteristics were included as covariates

Table 2 Means, Standard Deviations, and Significance Values of Variables

	M, (*SD*)—mindfulness ($n = 43$)	*M*, (*SD*)—control ($n = 42$)	*p*
Age	19.93 (1.58)	20.29 (4.75)	.64
BMI	24.07 (7.60)	25.02 (6.88)	.55
Previous day fruit/vegetable intake	2.56 (1.25)	2.56 (1.98)	.99
Usual day Fruit/vegetable intake	2.00 (1.45)	2.00 (1.82)	1.00
Hunger	2.37 (.95)	2.12 (.86)	.20
Total TFEQ	40.63 (10.09)	40.17 (8.15)	.82
Cognitive restraint[a]	11.98 (3.82)	12.67 (3,92)	.41
Uncontrolled eating[a]	21.37 (6.55)	20.67 (6.48)	.62
Emotional eating[a]	7.28 (2.87)	6.83 (2.37)	.44
MES	75.44 (10.32)	76.19 (10.10)	.74
FFMQ	56.79 (9.95)	57.71 (10.35)	.68
Pre SMS	64.86 (16.53)	66.50 (16.39)	.65

[a]TFEQ subscale

Table 3 Food selected by percentage of participants

	M&Ms	Grapes	Both	None
Mindfulness ($n=43$)	14%	41.9%	41.9%	2.2%
Control ($n=42$)	16.7%	38.1%	42.9%	2.3%

Note: values displayed on this table were not significantly different

using ANCOVA, and they showed to have no significant effect (except hunger) on the observed results for either grapes or M&M consumption.

State Mindfulness

A 2 (condition: mindfulness, control) × 2 (time: pre, post) mixed design ANOVA was carried out, with the condition being a between subjects factor and the time being a repeated measures factor. There was a significant main effect of time $F(1, 83) = 4.15$, $p = 0.05$, $\eta_p^2 = 0.05$, and as predicted, state mindfulness significantly increased in the mindfulness condition but did not change in the control condition (mindfulness condition: post $M = 73.23$, $SD = 17.37$). There was also a significant interaction between the condition and time $F(1, 83) = 4.40$, $p = 0.04$, $\eta_p^2 = 0.05$. The main effect between conditions was not significant $F(1, 83) = 0.80$, $p = 0.38$.

Food Choice

The food choices between the mindfulness and control conditions were highly similar, with approximately 42% eating some of both foods, and approximately 15% choosing only M&Ms, χ^2 (3) = 0.18, $p = 0.98$ (see Table 3).

Food Consumption

Independent-sample *t*-tests were conducted separately to compare the amount of each food consumed between the mindfulness and control conditions. There was a significant difference in the consumption of M&Ms between the two conditions, with the mindfulness condition consuming significantly less M&Ms (grams: $M = 9.42$, $SD = 13.19$; kCal: $M = 48.22$, $SD = 67.55$) than the control condition (grams: $M = 18.45$, $SD = 20.11$; kCal: $M = 94.48$, $SD = 102.95$); $t(70.5) = -2.44$, $p = 0.02$, $d = 0.53$ (see Figs. 1 and 2). There was no significant difference found in the consumption of grapes between the mindfulness condition (grams: $M = 37.91$, $SD = 31.02$; kCal: $M = 27.29$, $SD = 22.33$) and control condition (grams: $M = 29.76$, $SD = 29.53$; kCal: $M = 21.43$, $SD = 21.26$); $t(83) = 1.24$, $p = 0.22$ (see Figs. 1 and 2).

Effects of Hunger

Hunger was used as a covariate to test the effect that it may have had upon participants' consumption of M&Ms and grapes. A between-subject ANCOVA revealed that hunger had a significant effect upon the amount of M&Ms consumed $F(1, 82) = 4.04$, $p = 0.05$, $\eta_p^2 = 0.05$, but had no significant effect on the amount of grapes consumed $F(1, 82) = 1.12$, $p = 0.29$. The significant effect of hunger on the amount of M&Ms consumed was followed up by *t*-tests, as well as non-parametric tests, namely the Mann–Whitney *U*, due to the rather skewed distribution.

No Hunger and M&M Consumption An independent-sample *t*-test and Mann–Whitney *U* was conducted to compare the amount of M&Ms consumed between the mindfulness and control conditions in participants with no hunger.

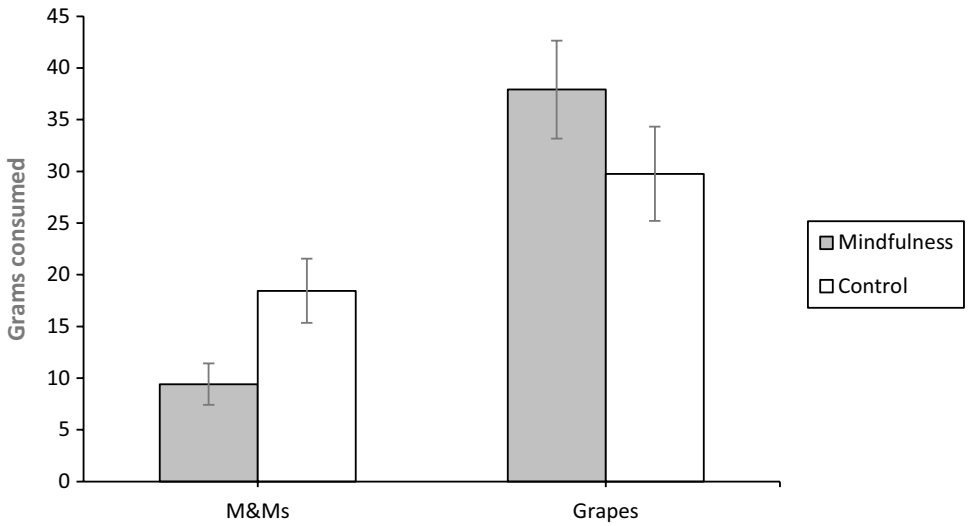

Fig. 1 Consumption of M&Ms and grapes in grams across mindfulness ($n = 43$) and control ($n = 42$) conditions. Error bars refer to the standard error of the mean

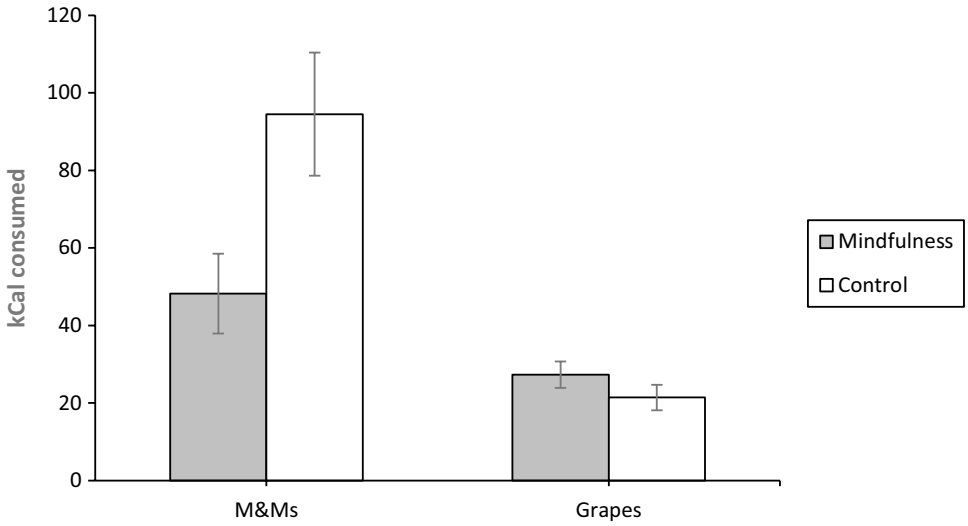

Fig. 2 Consumption of M&Ms and grapes in kCal across mindfulness ($n=43$) and control ($n=42$) conditions. Error bars refer to the standard error of the mean

There was no significant difference found in the consumption of M&Ms between the mindfulness condition (grams: $M=4.38$, $SD=7.29$; kCal: $M=22.40$, $SD=37.32$) and control condition (grams: $M=7.00$, $SD=9.19$; kCal; $M=35.84$, $SD=47.05$); $t(16)=-0.66$, $p=0.52$; $U=33.50$, $p=0.53$ (see Fig. 3).

Some Hunger and M&M Consumption An independent-sample *t*-test and Mann–Whitney *U* was conducted to compare the amount of M&Ms consumed between the mindfulness and control condition in participants with some hunger. There was a significant difference found in the proportion of M&Ms consumed between the two conditions, with the mindfulness condition consuming significantly less M&Ms (grams: $M=10.57$, $SD=14.03$; kCal: $M=54.13$, $SD=71.81$) than the control condition (grams: $M=22.03$, $SD=21.32$: kCal: $M=112.81$, $SD=109.17$); $t(52.84)=2.57$, $p=0.01$, $d=0.64$; $U=381.50$, $p=0.02$ (see Fig. 3).

Effect of Hunger on M&M Consumption by Condition Furthermore, independent-sample *t*-tests and Mann–Whitney *U* were conducted separately to explore consumption of M&Ms between participants who displayed no hunger and some hunger within the control and mindfulness conditions. There was a significant difference in consumption of M&Ms within the control condition, with participants who displayed no hunger consuming significantly less M&Ms than those who presented with some hunger, $t(35.55)=3.16$, $p=0.003$, $d=0.92$; $U=92.00$, $p=0.04$. There was no significant difference in consumption of M&Ms within the mindfulness condition between participants who displayed no hunger and some hunger, $t(41)=1.21$, $p=0.24$; $U=106.00$, $p=0.26$ (see Fig. 3).

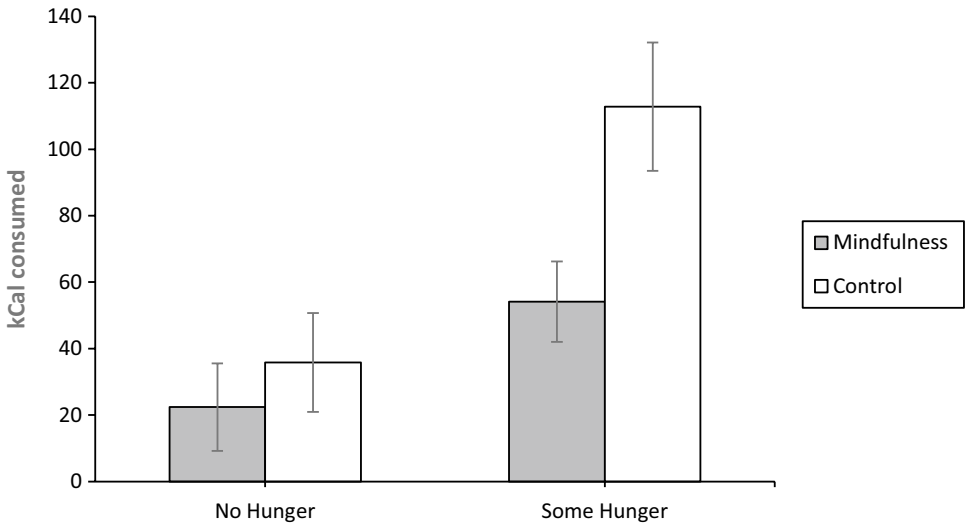

Fig. 3 Consumption of M&Ms in kCal across mindfulness—no hunger ($n=8$), control—no hunger ($n=10$), mindfulness—some hunger ($n=35$), and control—some hunger ($n=32$). Error bars refer to the standard error of the mean

Discussion

The present study examined whether the Mindful Construal Reflection could be an effective tool in promoting healthier food choices. The findings suggest participants in the mindfulness condition ate significantly less M&Ms than participants in the control condition, but no significant differences were found in the consumption of grapes between the two conditions. Furthermore, control participants ate significantly more M&Ms when displaying some hunger compared to those presenting no hunger, and participants in the mindfulness condition also ate more when displaying some hunger, though this did not reach statistical significance. Other characteristics such as age, BMI, previous and usual day fruit/vegetable intake, total TFEQ, TFEQ subscales (e.g., cognitive restraint, uncontrolled eating, and emotional eating), MES, and FFMQ were tested as covariates, and they had no significant effect on the findings. Collectively results suggest that utilizing the MCR may function as an effective method in reducing unhealthy eating.

Results are explained through three potential avenues. First, the procedure of reading and reflecting on the MCR may have led participants to consume less M&Ms because they may have placed a greater focus upon their internal cues of hunger and considered the nutritious elements of the food instead of simply focusing on the attractiveness of the food. The engagement of the MCR and considering questions related to their hunger, taste, and healthiness of the snack may have been sufficient to overcome the initial temptation of selecting the M&Ms, thus resulting in a reduced consumption of M&Ms. This is supported by research that has suggested that encouraging participants to be aware of and rely on internal signals of hunger and satiety might reduce the influence of external cues, such as attractiveness, which may in turn diminish the effects of unhealthy eating (Dalen et al., 2010).

Secondly, the mindful intervention used in this study was an eating-specific exercise, and the focus of the intervention was to be mindfully aware of the taste, texture, likability, and healthiness of the food being consumed. Jordan et al. (2014) suggested that even without mindful eating–specific instructions, mindfulness can encourage healthier eating; this study suggests that engaging with the MCR is perhaps more effective for healthier eating than generic mindfulness techniques or other eating-specific mindful methods (see also Kabat-Zinn, 2006; Mantzios & Wilson, 2015). The MCR is suggested to enable participants to adopt a mindful eating attitude, that is being aware of what they are eating and placing a focus on its nutritious benefits which then enables healthier eating choices. This method may also offer a more accessible and sustainable technique to be applied at each meal/snack than a body scan exercise, which is not eating-specific, and while there is evidence for accessibility and efficacy of the body scan exercise (Al-Chalabi et al., 2008), for some people, it may be seen as more effortful. Furthermore, even in the case of using an eating-specific method, such as guided recordings of the mindful eating-raisin exercise (Kabat-Zinn, 2006), there is clear evidence for promoting healthier eating behaviors (e.g., Hong et al., 2011, 2014). However, the original recording is 17 min long (Kabat-Zinn, 2006), and although other researchers have used a shorter version of the recording lasting 10 min (Hong et al., 2011), this may still be too long to practice before every meal. As such, listening to a recorded message may not be as feasible in comparison to perhaps the MCR which can be quickly read and reflected upon.

Thirdly, participants may have found it easier to engage with the MCR as it was used as a priming tool. Previous research on priming has shown its success in promoting healthier eating behaviors (e.g., Papies et al., 2014). The act of allowing participants to simply read and consider the answers to the questions rather than writing out answers could act as a more mindful and less distracting approach towards eating, thus consciously leading towards healthier eating behaviors.

Limitations and Future Research

There are some potential limitations to the present study that require further attention. Firstly, while consumption of M&Ms was reduced in the mindfulness condition, consumption of grapes did not increase. This could suggest that the MCR may be beneficial for reducing unhealthy eating (i.e., high fat and sugar foods), but may not necessarily encourage consumption of healthier food options (i.e., fruit). Further research should investigate methods that can be applied within the MCR that encourage the consumption of fruit (or other healthier food options, such as vegetables).

Moreover, the present study was conducted on relatively lean and highly educated students, while previous studies have indicated that people who are overweight or obese are more likely to engage in energy-dense snacking (Hartmann et al., 2012). In order to better understand the potential of this intervention, future research should specifically focus on populations at risk and in need for such interventions, as the engagement and acceptability in such populations is of primary importance.

Furthermore, this study was conducted in a highly controlled laboratory, and real-life situations may not be so clear-cut when it comes to choosing between healthy and

unhealthy foods. However, the long-term application of using Mindful Construal Diary within home and personal settings did find significant improvements in weight loss, suggesting people are able to implement it within their daily life (Mantzios & Wilson, 2014). The MCR in essence requires less time, commitment and effort, and adopting healthier eating choices may indeed come through this short and accessible mindfulness practice (Mantzios & Giannou, 2018). However, further long-term follow-ups are essential in concretely determining the impact of the MCR upon participants' eating behaviors and weight loss (Mantzios & Wilson, 2015).

Finally, the MCR (and MCD) has previously demonstrated an ability in increasing people's self-compassion (Hussein et al., 2017; Mantzios & Wilson, 2014). Self-compassion is described as taking a kinder approach to oneself with a mindful awareness and consideration of personal difficulties as being part of a shared humanity that everyone experiences (Neff, 2003). Both mindfulness and self-compassion appear to be inter-related, with literature suggesting that the combination of both capacities tends to improve psychological well-being and weight loss (e.g., Neff & Germer, 2013; Mantzios & Wilson, 2015). Recent research has looked into the component of self-kindness within self-compassion and found wide variations in behaviors (Egan & Mantzios, 2017). In their research, they found that the act of self-kindness for some people involved binge drinking or over-indulging on their favorite foods, and for others, it consisted of taking a warm bath or eating a healthy meal (Egan & Mantzios, 2017). They explained that the former group displays behavior that may lead to negative health consequences and only refers to a perceived sense being "kind" to the mind (i.e., one's thoughts, feelings, and emotions), while the latter group displays behaviors that relate to self-kindness of both the mind and body (i.e. psychological and physiological self-kindness; Egan & Mantzios, 2017) and, therefore, is perhaps a truer model of self-compassion and the golden standard of self-care (Neff, 2003, 2009). Future research should investigate how the state of self-kindness combined with mindfulness could influence eating choices and behaviors via experimental settings.

The findings from the present study indicate that utilizing and engaging with the MCR may be an effective method in encouraging healthier eating behaviors by reducing consumption of foods high in fat and sugar. However, future research should investigate the use of the MCR among varied populations as well as apply strategies that encourage consumption of healthier food options.

Author Contribution MH designed the study, collected data, conducted data analyses, and wrote the manuscript. HE, RK, and MM supported the study and reviewed the manuscript. All authors gave their final approval of the manuscript.

Declarations

Ethics Approval All procedures have been approved by the institutional research committee at Birmingham City University and have been performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Informed Consent Informed consent was obtained from all individual participants included in this study.

Conflict of Interest The authors declare that they have no conflict of interest.

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